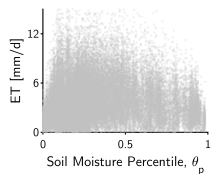


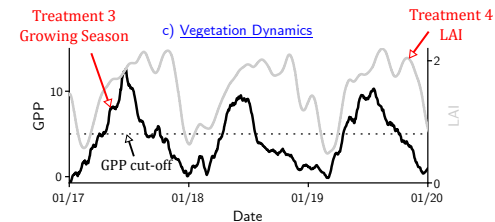
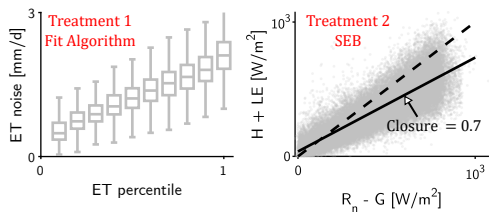
Step 1. Control Eddy Covariance Data Uncertainty

a) Baseline Filtering for All Assumptions



LE, H, R_n, GPP > 0
T_a > 5°C
VPD_a > 0.5kPa
RH < 95%
Remove 48 hrs after rain
Observed or HQ gapfill

b) Noise and Bias



c) Vegetation Dynamics

Step 2. Specify Model to Infer Stress

Treatment 8 VPD **d) PMOC Model Structure** **Treatment 5** Gc Eqn.
 $G_c = f(\text{VPD}, \text{GPP}, C_a; \mathcal{P})$ (Eqn. 2 or S5)
 $\text{ET} = f(G_c, \text{VPD}_a, R_n, G_a, T_a, P_a)$ (Eqn. 1)

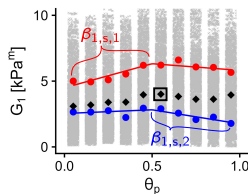
e) Fit Parameters to Data

$\mathcal{P} = (G_o, G_1, m)^T$ **Treatment 6** Fitting Parameters
minimize $\mathcal{F}(\mathcal{Y}_{\text{mdl}}(\mathcal{P}) - \mathcal{Y}_{\text{obs}})$
subject to $\mathcal{P} \in \Omega_{\mathcal{P}}$ **Treatment 1** Fit Algorithm (again) **Treatment 7** Response Variable

Step 3. Extract Dominant Stress Signals and Performance from 2,304 Assumption Sets (AS)

f) Soil Water Stress

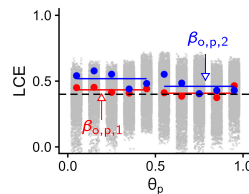
$G_1 = \beta_{o,s,i} + \beta_{1,s,i} \cdot \theta_p$
Critical: $|\beta_{1,s,i}| \geq 0.4$



AS 1 • PMOC Fit for single AS
AS 2 ♦ Median G₁ for θ_p bin

g) Predictive Performance

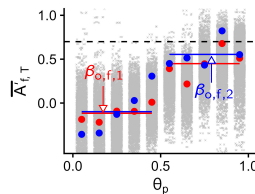
$\beta_{o,p,i} = \overline{\text{LCE}}$
Critical: $\beta_{o,p,i} \geq 0.4$



— Stress or Performance Signal for single AS

h) Functional Performance

$\beta_{o,f,i} = \overline{\Lambda_{i,T}}$
Critical: $\beta_{o,f,i} \geq 0.7$

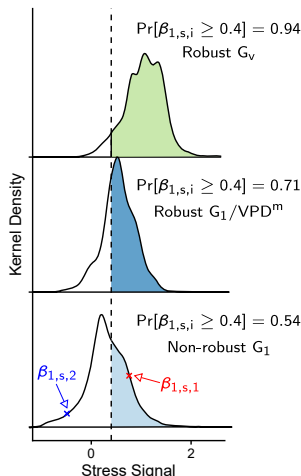


--- Critical Performance Threshold

Step 4. Apply Robust Soil Water Stress Framework

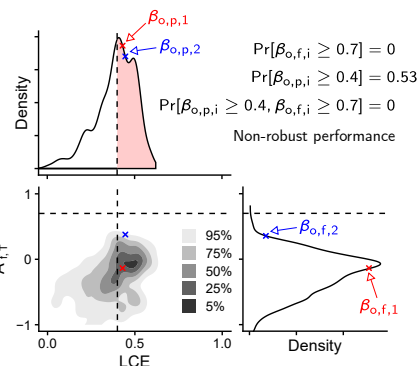
i) Robust Stress (o) Criteria

70% of AS exceeding the critical stress threshold for at least 2 of 3 ecosystem parameters



j) Robust Performance (+) Criteria

70% of AS jointly exceeding the critical predictive and functional performance thresholds



Stress: 2 out of 3 Robust
Performance: Non-robust
Robustness Class: Robust Stress (o)